ABSTRACT

A bi-directional optical transmission system according to the present invention provides transport of x optical channels over n nodes. The system supports two-way transport of the x channels over a single fiber connecting each of the nodes in sequence. The system is advantageous in that only two optical transmission bands are utilized in order to achieve minimal loss in the separation of bands. The two directions of optical transmission on the fiber between the end nodes have a spectral (wavelength/frequency) separation, in addition to directional separation. The use of only two bands permits the utilization of low-loss wide band thin film optical filters to combine and separate the signals at each node. Further processing of the signals takes place in unidirectional components, e.g., multiplexers, demultiplexers and amplifiers, as required. An alternating arrangement of the optical filters in the two separate bands is chosen to maximize the optical performance of the overall system and significantly reduce insertion losses. In one exemplary embodiment of the present invention, at each intermediate node in the system a transmission filter for the first band of optical signals is used between the output of an optical amplifier for the first band and the bi-directional fibers. A reflection port of this filter is used to carry oppositely directed signals of the second band from the bi-directional fiber to an optical amplifier for the second band. An optical transmission filter for the second optical band is also used at each intermediate node between the output of an optical amplifier for the second band and the bi-directional fiber. The reflection port of the second band filter is used to carry the input signal of the first band from the bi-directional fibers to the optical amplifier for the first band. End nodes in the system include only an appropriate one of the transmission filters. The alternate arrangement of filters simultaneously provides for optimal signal performance for both directions of transmission at every node in the system while at the same time minimizing insertion losses from filtering components.